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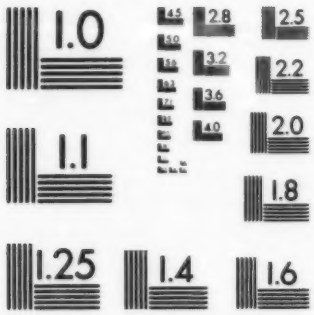

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INDUSTRIAL TECHNOLOGY CENTRE

a division of the
Manitoba Research Council

INDUSTRIAL TECHNOLOGY CENTRE

SERVICES AND CAPABILITIES

April, 1987

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INDUSTRIAL TECHNOLOGY CENTRE

1.0 INTRODUCTION

The Industrial Technology Centre (ITC) was established by the Manitoba Research Council as a product development and testing facility to serve Manitoba industry. To this end, the Centre has become involved in a wide range of projects and is accredited by the Standards Council of Canada for specific tests registered with the Council.

The objectives of the ITC are to: provide scientific and technical services to industrial and government clients, stimulate the application of new technology in industry, aid in translating technology into manufacturing opportunities, and assist industry in monitoring and testing its products and workplace environments. Two types of services are provided to industrial clients, namely; consulting, product development and testing services on a contractual basis - and a wide range of technical information and advisory services.

Areas of Centre expertise are in biotechnology, chemical technology, computer aided engineering, electrical and electronics engineering, mechanical and manufacturing engineering, and materials engineering. The present capabilities and services provided by ITC are outlined in the following sections of this document.

Further information on the capabilities and services available to clients may be obtained by contacting the Industrial Technology Centre at:

1329 Niakwa Road East
Winnipeg, Manitoba
R2J 3T4

Telephone: (204) 945-6000
Fax: (204) 945-1784
Telex: 07-587833

2.0 TECHNICAL INFORMATION AND ADVISORY SERVICE

2.1 Introduction

ITC provides a comprehensive technical information and advisory service to assist clients in their technical and related business decision making processes.

2.2 Information Service

Our information resource and retrieval systems are integral to the success of all projects undertaken at ITC. A variety of information services are provided to business and scientific communities - ranging from literature searches to patent reviews. This client service is funded by the Manitoba government. The only charges which clients will incur when accessing this information service-are those computer data search and other information retrieval costs incurred in undertaking work for a client.

2.2.1 Literature Searches

Literature searches are conducted to produce bibliographies listing articles, reports, books or other publications. While the majority of searches are for bibliographic information, other searches are carried out for data which range from information on company sales to the identification of a substance according to an analysis of its atomic absorption spectrum.

2.2.2 Library Loans

Most material, except reference documents in the library, is available for loan to staff and clients.

2.2.3 Interlibrary Loans

The library cooperates with most other local and major Canadian libraries in an interlibrary loan system. These libraries also communicate through electronic messaging systems which enable ITC to obtain nearly all published material within a short period of time.

2.2.4 Fact Finding

Specific facts and figures may be obtained, such as addresses, telephone numbers, names of agencies and suppliers. ITC has access to a number of computer databases which also are used to obtain information required by clients.

2.2.5 Consulting Services

Assistance is provided in areas related to management or retrieval of information, such as reports, vendor literature, books, standards, or other documents.

2.2.6 Patent Information

Assistance is provided to clients in locating information in worldwide patent literature. This information is provided either as a source of technical information or as an indication of activity in a particular area. Searches are carried out to locate patents on a particular subject and may include English language equivalents of a foreign patent, additional information about and claims of particular patents, and information about the patent system. Through an Agreement with the Department of Consumer and Corporate Affairs, ITC can obtain a cross section of patents on a particular topic, and provide other intellectual property information.

2.3 Advisory Service

ITC recognizes that many clients require assistance in: evaluating manufacturing production and processes; assessing the viability of current and leading edge technologies; assessing computer options; defining the requirements of research and development projects. In order to address this need, ITC provides a no-cost advisory to Manitoba industry. This service is funded by the provincial government and by NRC through a contribution agreement with the Manitoba Research Council.

This service includes the following elements:

2.3.1 Industrial, electronic and manufacturing engineering services including: plant layout, equipment selection, review of manufacturing methods, value analysis/cost reduction, cost estimating, evaluation of new technologies, identifying source of components and services, assistance in product development and engineering documentation and control.

2.3.2 Provision of information on Provincial and Federal government programs which may assist a client in undertaking a required R & D project.

2.3.3 Delivery of the National Research Council-Industrial Research Assistance Program in Manitoba. The Industrial Research

Assistance Program (IRAP) - Field Network is directed towards medium to small firms. The program provides technical and financial assistance to foster the use of available technology, and to increase the calibre and range of research and development in industry.

2.3.4 ITC provides hands-on introductory demonstrations of VAX and PC based application systems to enable clients to develop staff expertise and evaluate software options. These options include Computer Aided Design Drafting (CAD), Computer Aided Manufacturing (CAM), Computer Aided Engineering (CAE) and Finite Element Analysis.

2.4 Facilities

2.4.1 Technical Library

ITC has an extensive collection of material on industrial technologies. It also has immediate access to the collections of many other resource centres, locally and throughout the country. Our collection includes over 3,000 books, 20,000 technical reports, 400 periodical titles, standards from over 300 organizations, many specialized product directories, a small collection of video tapes, and a microfilm service containing over two million pages of vendor catalogues. Contracts have been established with seven computer database services. These give immediate access to over three hundred databases covering a wide variety of topics. Examples of these include: general engineering articles, company information, electronics, welding, business news, suppliers, patents, plastics, safety, standards and market research.

2.4.2 Computer Facilities

ITC has a VAX 11/780 mini computer, and IBM, Sperry and MacIntosh personal computers. The software packages available for client demonstration include SDRC, Calma, Versacad, AUTOCAD, ANVIL, ALGOR SUPERSAP, Prodesign II, Learn, Payback, Plant Layout, Lotus, Multiplan, MacProject, Redlogg and Redboard.

2.5 Staff Contacts

Technical Information and Advisory Service

i) Advisory Service

Mr. R. Quirk, P. Eng.
Head, Technical Information and Advisory Service
(204) 945-6132

ii) Information (Library) Service

Mr. George Montgomery
Information Services Librarian
Technical Information and Advisory Service Department
(204) 945-6129

3.0 ELECTRICAL/ELECTRONICS ENGINEERING

3.1 Introduction

Electrical and electronics engineering services are offered by ITC which include design, product development assistance and general consulting.

3.2 Services

3.2.1 Design

The design services of ITC in most cases lead to the development of new products. These services centre around the following activities:

a) Electronic Circuit Design: This includes the design of a wide variety of devices ranging from simple to complex circuitry. The Centre is capable of turning a concept into a fully tested prototype.

b) Computer Based System Design: Systems range from microprocessor to minicomputer based products. Activities can include both hardware and software development.

c) Communications System Design. Services include design and implementation of protocols and design or selection of network hardware.

d) Industrial Applications: This includes plant modernization and automation, and process measurement and control.

3.2.2 Product Development Assistance

The following services are offered to clients engaged in product development:

a) Product Selection Assistance: Assistance is offered to clients in identifying and selecting products for use in prototype and product development.

b) Product Testing and Evaluation: This includes environmental and stress testing as well as premarket evaluation and consulting.

3.3 Past Projects

The following project list is a representative sample of past projects which illustrate the breadth of ITC's activities.

3.3.1 Micro to Mainframe Communications Controller

The client required a device which would allow multiple personal computers from a variety of vendors to exchange files with a mainframe computer. The Centre provided a solution consisting of an off-the-shelf microprocessor board and a custom designed communications controller. Extensive services were offered including system design, packaging design, hardware design and software design.

3.3.2 Automation of a Concrete Plant

The client required computer control of his batching operation. The Centre supplied a turn-key computer based solution. This involved subcontractor and trades management, hardware design and software design.

3.3.3 Transformer Design

The client presently supplies high intensity lighting kits to a variety of customers. The Technology Centre was contracted for the design of ballast transformers, ignitor circuits and manufacturing test equipment.

3.3.4 Feasibility Studies

A variety of feasibility studies have been undertaken including:

- Computer Based Truck Driving Simulator
- Air Seeder Instrumentation
- Plastics Production Line Instrumentation
- Remote control of underground mining equipment

3.4 Facilities

Our electrical/electronic laboratory is capable of supporting a variety of development and prototyping activities. Major equipment includes:

- Microprocessor development and debugging aids
- Computer aided engineering tools for printed circuit board development

- Oscilloscopes
- Logic analyzer
- Spectrum analyzer
- Protocol analyzer
- High frequency counters
- Radio frequency signal source
- Power supplies
- Digital volt meters
- Dielectric tester
- Power meter

3.5 Staff Contacts

Mr. K. Thacher, P. Eng.
Head, Electrical/Electronics Engineering Department
(204) 945-6124

Mr. J. Hancharyk, P. Eng.
Senior Project Engineer
Electrical/Electronics Engineering Department
(204) 945-6121

4.0 MATERIALS ENGINEERING

4.1 Introduction

Materials Engineering services are provided by ITC to assist its clients to resolve problems involving materials testing and analysis, process development, and product testing and development.

4.2 Services

The following services are offered by ITC.

4.2.1 Material Testing and Product Evaluation

Testing is performed to CSA, CGSB, ASTM and other industry standards. In many cases, field service conditions are simulated to evaluate the performance of a new product. Through these services, design verification can be performed for new products/materials which can be made from plastics, metals or wood.

4.2.2 Metallurgical Analysis

Assistance is provided to clients in metallurgical evaluation of components in terms of hardness, tensile, compression and fatigue testing, metallography for microstructure examination and heat treatment. Analysis of failed components and weldments is routinely performed. Chemical analysis of materials and non-destructive testing of components are also available. These services are often employed by clients to evaluate product quality control. Larger projects can also be undertaken where a product is being developed using new metallurgical processes including heat treatment, electroplating, and powder metallurgy.

4.2.3 Advanced Industrial Materials

ITC offers technical information and advice for applications of new materials including fine ceramics, amorphous metals and composites.

4.3 Past Projects

The following project list is a representative sample of past projects undertaken by ITC:

- mechanical strength evaluation of polyethylene pipes
- dynamic testing of bus step-well
- compression testing of aluminum ladders

- failure analysis of copper/nickel tubes
- fatigue cracking of high strength steel studs
- hardness testing of aircraft components
- feasibility of using metallic glasses in force transducers

4.4 Facilities

The following equipment is used to support material engineering services provided by ITC:

- Universal Testing Machines up to 55000 lbf capacity (tension and compression), servohydraulic system permits fatigue testing.
- Impacter tester with low and high energy and temperature capabilities.
- Hardness testers - Brinell, Vickers, Rockwell, Barcol and Durmeter.
- Metallography - optical microscopes along with complete line of metal cutting, polishing and etching equipment.
- Environmental chamber - 40 to +60°C, programmable for temperature cycling.

4.5 Accredited Tests

ITC is accredited by the Standards Council of Canada as a testing Organization for specific tests registered with the Council. These tests are:

4.5.1 Building Materials:

Flammability of Insulated Panels (ITC Method)
Flexure, Modulus of Rupture of Glass and Windows (ASTM C158)
Performance of Safety Glass, Tempered or Laminated (CAN2-12.1M)
Structural Properties of Building Panels (ASTM E72)

4.5.2 Adhesives and Sealants:

Strength -
Peel, of Adhesive Bonds (ASTM D903)
Shear, Flat, of Sandwich Constructions (ASTM C273)
Shear, Lap, in Tension, of Rigid Plastic Joints (ASTM D3164)

4.5.3 Plastics:

Density of Rigid Cellular Plastics (ASTM D1622)
Strength -
Bursting, of Plastic Tubing (ASTM D1180)
Compressive, of Rigid Cellular Plastics (ASTM D1621)

Flexural (ASTM D790)
Tensile, of Rigid Cellular Plastics (ASTM D1623)
Strength of Plastic Pipe -
Constant Internal Pressure (ASTM D1598)
Hydraulic Pressure (ASTM D1599)
Tensile Properties. General (ASTM D368)

4.5.4 Rubber and Resins:

Compression Set (ASTM D395)
Hardness -
Durometer (ASTM D2240)
Durometer, of Elastomeric Sealants (ASTM C661)
Strength -
Tearing (ASTM D624)
Tensile (ASTM D412)

4.5.5 Metals:

Fatigue -
Constant Amplitude Axial (ASTM E466)
Hardness -
Brinell (ASTM E10)
Rockwell and Rockwell Superficial (ASTM E18)

Mechanical Properties. General -
Fasteners and Rivets (ASTM F606)
Steel, Structural Quality, Rolled or Welded (CAN3-G40.20-M)Truss
Plates in Lumber Joints (CSA S347)
Wrought and Cast Aluminum Products (ASTM B557)
Wrought and Cast Steel Products (ASTM A370)
Welds (ASME Boiler and Pressure Vessel Code, s. IX Welding and Braizing. Ar I and IV)
Strength -
Impact, Notched Bar (ASTM E23)
Tensile (ASTM E8)

4.5.6 Packaging:

Shipping Container Vibration (ASTM (D999)

4.5.7 Electrical Power Insulators:

Mechanical Tests (ANSICZ9.1 Section 5.1)

4.6 Staff Contacts

Dr. K. Tandon, P. Eng.
Materials Engineering Specialist
Mechanical Engineering Department
(204) 945-6130

5.0 MECHANICAL ENGINEERING

5.1 Introduction

ITC has experienced mechanical engineering staff and tools to support industrial clients in all phases of the product development cycle. This includes initial conceptualization, detail design, design refinement, preproduction engineering and product testing services. With ITC's support, client concepts are turned into manufacturing realities in a timely and cost effective manner.

5.2 Services

The mechanical engineering services assist clients by:

- providing improved product design to reduce production costs;
- reducing development times and costs; and
- improving product quality, reliability, performance and versatility.

These mechanical engineering services may be categorized as follows:

- Mechanical Design and Analysis
- Process Evaluation
- Prototype/Product Fabrication
- Product Testing

5.2.1 Mechanical Design and Analysis

The mechanical engineering staff provide product design and analysis assistance to industrial and government clients. Technical problems related to product form or packaging, function, structural integrity, system dynamics, safety and cost effectiveness are dealt with.

Most of the above work is done using advanced design tools such as the Integrated Design Engineering Analysis Software package of SDRC. This software, run on a VAX 11/780 computer, is a family of powerful programs that share a common database for the following:

- Solid modelling
- Finite element analysis
- Modal analysis
- Fatigue analysis
- System dynamic analysis

Detailed design drawings are produced using either a G.E. CALMA 3D drawing system (also run on the VAX 11/780) or VERSACAD, AUTOCAD, and ANVIL drawing systems available on a number of personal computers.

Product performance, reliability and cost may be thoroughly evaluated and understood before any commitment to manufacturing tooling is made. Costly prototype construction and development time is minimized when these techniques are utilized.

5.2.2 Process Evaluation

Assistance is provided to clients through the evaluation of processes to determine their viability and applicaility to client requirements and conformity to regulations.

5.2.3 Prototype/Product Fabrication

Fabrication of prototypes and products are possible through the use of ITC's machine shop. This facility offers custom machining and fabrication services to produce and test prototypes to customer specifications. These include:

- general machine work using conventional equipment
- sheet metal fabrication
- general welding and steel fabrication
- heat treating (limited)
- E.D.M. (travelling wire) limited applications for tool and die, fixtures, gauges and templates

5.2.4 Product Testing

ITC is accredited by the Standards Council of Canada as a testing organization for specific tests registered with the Council.

5.2.5 Vibration/Modal Analysis

Modern equipment is employed for field measurement and analysis of noise and vibrations in plant machinery. Structural failures related to excessive vibrations can be evaluated through modern computer aided modal analysis techniques.

5.3 Past Projects

The following list is representative typical mechanical engineering projects undertaken for ITC clients:

- upgrading and automation of manual tree delimber

- design and manufacture of prototype ice jigger

- manufacture of a prototype electronic equipment mounting panel

- finite element analysis of a car shredder hammer

- design and modelling of an open shed dwell type dobby

- vibration monitoring of calender stacks in a paper mill

- vibration monitoring of generator cooling tubes

- experimental development and dynamometer testing of an ammonia fueled engine for the National Research Council

- vehicle and engine performance testing of alternative fuels including gasohol propane, and methanol both low percentage and neat blends.

- Feasibility Studies and Review
  A variety of studies have been carried out including:
  . solids reduction in tannery effluent
  . equipment evaluation for environmental improvement to a battery reclamation plant
  . processes for the reduction of sulfur dioxide stack gas emissions
  . design review of a crop divider

5.4 Facilities

The following software and equipment is used by mechanical engineering staff:

- SDRC's IDEAS software which includes a finite element stress analysis package for beam structures (FRAME), an interactive finite element stress analysis package for solids and shells (SUPERTAB/SUPERB) and an interactive solids modeller (GEOMOD) and component assembler (SYSTEM DESIGN).

- GE's interactive three dimensional wire frame modeller and design drafting system (CALMA DDM).

- 4-Channel FFT analyzer for vibration and sound analysis.

  4-Channel FM tape recorder, and vibration table (shaker).

- Engine dynamometer test cell with computerized data acquisition system.

- Exhaust emission analysis equipment.

- EDM cutting on an Andrews 2-axis travelling wire electric discharge machine.

- machine shop for prototype development.

5.5 Staff Contacts

i) General Consulting, and Product Development and Testing

Mr. T. Cornell, P. Eng.
Head, Mechanical and Materials Engineering Department
(204) 945-6126

ii) Mechanical Engineering Design and Vibration Analysis Service

Mr. G. Pizey, P. Eng.
Senior Design Engineer
Mechanical and Materials Engineering Department
(204) 945-5936

6.0 CHEMICAL TECHNOLOGY

6.1 Introduction

Chemical and biotechnology services are offered by ITC to assist clients in analysis and testing, and product research and development.

6.2 Services Offered

6.2.1 Chemical and Microbiological Analysis

Testing is performed following approved standards, such as ASTM, CSA, NIOSH and AOAC. The following is a partial listing of the types of analytical services offered by ITC.

a) Hazardous Wastes:
The components of industrial wastes can be identified and quantified, to ensure that proper handling and disposal procedures are applied.

b) Air Quality Monitoring:
Organic and inorganic airborne contaminants in the workplace can be identified and quantified.

c) Quality Control:
Fuels, lubricants, solvents, and raw and finished products can be tested for contaminants and to ensure that standards are met.

d) Environmental Contaminants:
Herbicides, pesticides, and industrial wastes such as PCB's can be monitored in soil, vegetation, water, and air.

e) Microbial Contamination:
Products as diverse as fuels and cosmetics can be tested for microbial content.

f) Non-Routine Testing:
The application of ITC's analytical services can aid in determining the causes of product failure, identify unknowns, and provide solutions to problems.

6.2.2 Product Development Assistance

Clients are provided with assistance in the development of their products by:

a) Material Evaluation and Sourcing:
Assistance is offered to clients in evaluating and selecting materials used in product development.

b) Formula Review:
Assistance is provided to select and improve product formulations.

6.3 Past Projects

The following list is illustrative of the range of chemical technology projects undertaken for ITC clients:

6.3.1 Alternative Fuels Testing

The federal and provincial energy ministries contracted ITC to develop and test alternative fuels for road vehicle use. These fuels included gasohol, propane, and methanol-both low percentage and neat blends.

These programs involved the development of a quality assurance fuel and vehicle testing system. This was required to permit the determination and evaluation of anomalies which could affect vehicle performance. To this end, the scope of work under these programs included: fuel and lubricant analysis, fuel formulation and evaluation, vehicle and engine performance testing, and the adjustment of vehicles to achieve improved performance under Manitoba climatic conditions.

6.3.2 Hazardous Waste Analysis

ITC provided an essential service to clients who required the analysis of hazardous wastes for such parameters as PCB's, chlorophenols, petroleum residues, and heavy metal contamination.

6.3.3 Monoclonal Antibody Production

ITC is producing monoclonal antibodies to be used in the development of simple and effective diagnostic tests for Manitoba's agricultural industry.

6.3.4 Air Quality Monitoring

ITC has monitored lead and organic solvents in air in industrial/manufacturing workplaces.

6.4 Facilities

ITC has sample pretreatment and preparation facilities, and the following analytical chemistry instrumentation and biotechnology equipment:

a) Analytical Instrumentation
- five gas chromatographs with FID, ECD, TSD, NPD, and TC detectors
- gas chromatograph with mass selective detector (MSD)
- a high performance liquid chromatograph with refractive index, uv/vis, fluorescence, pulsed amperometric, and conductivity detectors
- an atomic absorption spectrophotometer with graphite furnace and hydride generator
- an IR and a UV/VIS spectrophotometer
- full range of equipment for fuel and oil analysis

b) Biotechnology Equipment
- tissue culture facility
- electrophoresis (vertical/horizontal systems)
- high speed centrifuge
- continuous fermenter
- ELISA plate reader

6.5 Accredited Tests

ITC is accredited by the Standards Council of Canada as a Testing Organization for the following specific tests registered with the Council.

- Aromatics by Gas Chromatography (ASTM D2267)
- Ethanol in Gasohol (ITC Method)
- Methanol and Isobutanol in Gasohol (ITC Method)
- Methanol and Isopropanol in Gasohol (ITC Method)
- Sulphur by General Bomb (ASTM D129)
- Water by Karl Fischer Reagent (ASTM E203)
- Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (ASTM D240)
- Vapour Pressure by Reid (ASTM D323)
- Volatility. Distillation (ASTM D86)
- Manganese in Gasoline by AA (ASTM D3831)
- Lead in Gasoline by AA EPS (1-AP-73-3)
- Gasoline Dilutent by GC (ASTM D3525)
- Insolubles in Used Lubricating Oils (Procedure B)(ASTM D893)
- Specific Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer (ASTM D1298)
- Water and Sediment in Fuel Oils by Centrifuge (ASTM D1796)

- Calorific Value of Solid Fuels by Adiabatic Bomb (ASTM D2015)
- Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445)
- Neutralization Number by Potentiometric Titration (ASTM (D664)
- Standard Test Methods for Cyanides in Water, Methods A and C (ASTM D2036)
- Polychlorinated Biphenyls in Oil (EPA)
- Ignition loss of Cured Reinforced Resins (ASTM 02584)

6.6 Staff Contacts

i) Consulting and Testing Services

Mr. G. Lypka
Head, Chemical Technology Department
(204) 945-6163

ii) Analytical Chemistry Testing Service

Mrs. M. Velpel
Laboratory Manager
Chemical Technology Department
(204) 945-8169

iii) Biotechnology Service

Dr. M. Dawood
Biotechnology Consultant
Chemical Technology Department
(204) 945-6162

7.0 ALPHABETICAL LISTING OF CONSULTING AND ADVISORY SERVICES

7.1 Technical Information and Advisory Service

- Advisory Service

Contact:

. Industrial and Manufacturing Engineering
. Analytical Chemistry
. Biotechnology
. Construction Engineering
. Electrical/Electronics Engineering
. Government Programs (eg. IRAP)
. Materials Engineering
. Mechanical Engineering

Mr. R. Quirk
Phone: (204) 945-6132

- Information (Library) Service

Contact:

. Data Base Searches
. Component Sourcing
. Library Loans
. Patent Information

Mr. G. Montgomery
Phone: (204) 945-6129

7.2 Electrical/Electronics Engineering

Contact:

- Analog/Digital Circuit Design
- Communications System Design
- Computer Communications and Protocol Implementations
- Electrical/Electronic Engineering
- Electronic Circuit Redesign and Upgrading
- Fact Finding
- Feasibility Studies
- Industrial Monotoring, Control, and Automation
- Lamp Ballast Design
- Literature Searches
- Microprocessor Based Circuit Design
- Microprocessor System Design
- Microprocessor Software Development (realtime, multitasking, etc.)
- Microcomputer, Minicomputer Software Development
- Plant Automation
- Power Supplies
- Printed Circuit Board Layout
- Process Instrumentation and Control
- Product Certification Assistance
- Product/Component Sourcing and Selection
- Product Enhancements and Retrofit
- Project Management
- Prototype Design
- Quality Assurance and Control Procedures

Mr. K. Thacher
Phone: (204) 945-6124

Mr. J. Hancharyk
Phone: (204) 945-6121

7.3 Mechanical/Materials Engineering

- Failure Analysis
- Feasibility Studies
- Literature Searches
- Material Applications
- Material Evaluation
- Mechanical Design Engineering:
  - . Computer Aided Design/Drafting
  - . Fatigue Analysis
  - . Finite Element Analysis
  - . Modal Analysis
  - . Product Costing
  - . Product Design
  - . Product Evaluation
  - . Product Performance
  - . Product Reliability
  - . Prototype Design
  - . Solid Modelling
  - . System Design
  - . System Dynamic Analysis
  - . Thermal Analysis
- Metallurgical Evaluation
- Noise Measurement
- Process Evaluation
- Product Reliability
- Prototype Fabrication:
  - . Electrical Discharge Machining (wire EDM)
  - . General Machining
  - . General Fabrication/Welding
  - . Heat Treating
- Vibration Measurement/Analysis/Resolution

Contact:

General Consulting, and Product Development Testing Services
Mr. T. Cornell
Phone: (204) 945-6126

Mechanical Engineering Design/Vibration Analysis
Mr. G. Pizey
Phone: (204) 945-5936

Materials Engineering/ Metallurgy
Dr. K. Tandon
Phone: (204) 945-6130

7.4 Chemical Technology

- Formula Reviews
- Product Formulations
- Product Improvements
- Product Sourcing

Contact:

Mr. G. Lypka
Phone: (204) 945-6163

8.0 ALPHABETICAL LISTING OF TESTING SERVICES

8.1 Electrical/Electronics Engineering

Contact:

Mr. K. Thacher
Phone: (204) 945-6124

- Extreme Temperature/Humidity Stress
- Product Performance Testing
- System Troubleshooting

8.2 Chemical Technology

Contact:

Chemistry
Mrs. M. Velpel
Phone: (204) 945-8169

Biotechnology
Dr. M. Dawood
Phone: (204) 945-6162

- Air Analysis
- Air Quality
- Atomic Absorption Spectrophotometry
- Calorific Content
- Chemistry
  - . Inorganic analysis
  - . Organic analysis
  - . Physical testing
- Contaminants Analyses
- Distillations
- Environmental Contaminants
- Flash Point
- Fuels Analysis
- Gas Analysis
  - . Fixed gases
  - . Hydrocarbon gases
- Gas Chromatography
- Hazardous Wastes Analysis
- Heat of Combustion
- Herbicide Analysis
- High Performance Liquid Chromatography
- Infrared Spectroscopy
- Lubricants Analyses
- Metals Analyses (ferrous and non-ferrous)
- Microbial Contamination
- PCB Analysis
- Pesticides Analysis
- Petroleum Products
- Physical Chemistry
- Pollution Monitoring
- Quality Control
- Soil Analysis
- Solvent Analysis
- Trace Metals
- Transformer Gas Analysis
- Viscosity
- Waste Materials Analysis
- Water Analysis
- Workplace Monitoring

8.3 Mechanical/Materials Engineering

- Adhesives and Sealants:
  . Peel strength (adhesive bonds)
  . Shear (flat) strength (sandwich construction)
  . Shear (lap) strength (rigid plastic joints)

- Building Materials:
  . Flammability (insulated panels)
  . Flexure, Modules of rupture (glass)
  . Performance of Safety Glass (tempered or laminated)
  . Structural Properties (building panels)

- Electrical Power Insulators - Mechanical Tests

- General:
  . Calibration
  . Engine Dynamometer
  . Environmental (temperature cycling)
  . Exhaust Emission Analysis
  . Product Evaluation/Performance
  . Retention/Release (bus windows)

- Metals Testing:
  - Compression
  - Fatique Strength
  - Hardness - Brinell and Rockwell
  - Impact, Notched Bar
  - Mechanical Properties -
    . Fasteners and Rivets
    . Steel, Structural Quality
    . Truss Plates in Lumber Joints
    . Wrought and Cast Aluminum Products
    . Wrought and Cast Steel Products
    . Welds

- Tensile Strength

- Metallography - Grain size, Heat-Treatment, Microstructure

- Packaging - Shipping Container Vibrations

- Plastics:
  . Bursting Strength (plastic tubing)
  . Compressive Strength (rigid cellular plastics)
  . Flexural Strength
  . Hydraulic Pressure Strength (pipes)
  . Internal Pressure (pipes)
  . Tensile Properties

Contacts:

General Consulting, and Product Development and Testing Services
Mr. T. Cornell
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Materials/Metallurgy
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- Rubber and Resins:
  . Compression Set
  . Hardness - Durometer
  . Strength - Tearing and Tensile
  . Vibration/Measurement/Analysis

The Manitoba Research Council operates two technology centres:

INDUSTRIAL TECHNOLOGY CENTRE - Winnipeg - Telephone: (204) 945-6000
Fax: (204) 945-1784
Telex: (07-587833)

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Fax: (204) 239-5183

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